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25X1 OSI/LSD/ [redacted] (1 Sep 65)

3 SEP 1965

MEMORANDUM FOR: Director of Central Intelligence

THROUGH: Deputy Director for Science and Technology

SUBJECT: Soviet Capabilities in Thought Detection

25X1 **REFERENCE:** [redacted] Request for Material on a Surveyor Item, Same Subject

1. This memorandum is for information only; particular reference is made to paragraph 3.

25X1 2. [redacted] requested additional support material concerning a Surveyor item "Can Cybernetic Machines Accomplish Mind Reading?" published on 12 August 1965. Appendix 1 describes Soviet research on the subject. Appendix 2 gives additional background information on Soviet attitudes which led to the research in question.

3. The prospect for Soviet use of a "mind reading" technique seems to be relatively good in view of the supportive research and development that is being carried out in the USSR. Such a process does not really constitute mind reading but rather consists of detecting subvocalized expressions of thought. This can be of most utility in a modified lie detector where a good possibility exists that the subject will respond to direct questions in a manner which can be detected by monitoring the laryngeal apparatus. The actual achievement of such an advance in physiological monitoring now seems to be a few years in the future at the present level of effort. In addition, technical advances in electroencephalography (brain wave techniques) could provide support to facilitate this so-called mind reading. To summarize, there is a distinct possibility that in the next several years the Soviets will achieve a device useful for very advanced lie detection procedures.

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DONALD F. CHAMBERLAIN
Director of Scientific Intelligence

Appendices:
1. Requested material
2. Background material

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APPENDIX 1

SOVIET TECHNIQUES APPLICABLE TO THE OBSERVATION OF SPEECH-ASSOCIATED BEHAVIOR

The Soviets have used the polygraph in many experimental situations. It provides information on the visceral changes associated with any type of somatic behavior including speech and thought. Visceral changes are part of the emotional complex. The emotional complex is, in turn, dependent upon the cultivation of personal and social moral codes. If these are quite stereotyped, so also would be the visceral responses to somatic stimulation, such as questions to be answered. Unusual visceral response should identify an unusual somatic effort, such as falsification.

The early Soviet efforts in the area of lie detection established a different approach. A. R. Luriya carried out a series of investigations, many years ago, which set a procedure still used in the field of lie detection. He chose to examine somatic correlates such as muscle tension, rather than the vegetative correlates obtainable by the use of the polygraph. He felt that muscle tension was a step closer to the tension changes in the vocal apparatus than were any of the vegetative reflexes. He also reasoned that limb gestures were very closely associated with articulative efforts and probably also with tensions observable in thinking.

Luriya's tests were simple and conducted speedily with little apparatus. He worked out an elaborate system of word associations to fit most any suspected situation. The subject being examined simply placed his hand upon a sensitive pressure recording device. Luriya could obtain a tension curve, not only for word associations, but for the total discourse involved in the test situation. He felt that his tests were quite objective since all sorts of simulated crimes were worked out on many subjects over a period of five years. Testing diagrams of speech patterns were worked out for both overt and thought-out answers to word associations and answers to questions. These permitted "quick-look" diagnoses which were useful in determining the nature of emotional tension as well as the unusual situations which needed more detailed testing. 1/

Luriya's interest in bodily activity associated with speech and thought led him into an investigative career on speech development in young children, both normal and defective. Associated with him was the psycho-physiologist Ye. N. Sokolov, who had worked out the behavioral correlates for the orienting reflex. Together they defined experimentally the somatic and visceral responses associated with the learning of words and the development of speech. Their apparatus and investigation techniques became quite sophisticated. The polygraph was used to test the vegetative responses such as changes in respiration, pulse rate and blood pressure. The plethysmograph was used to determine changes in blood distribution to the limbs. The electroencephalograph was used to determine the effects of speech and thought upon the brain waves. The myograph was used to determine the effects of speech upon eye movements and the reflectometer was used to record reflected light from the eyeball surface upon a photographic recorder.

The work of Sokolov and Luriya established an understanding of behavioral stability in the learning process. When words, phrases, or more complicated verbiage was presented to experimental subjects, the orienting reflex appeared and then gradually decreased as learning became secure. This, according to Sokolov, established a brain model. It represented learned fact for the subject and no more orienting occurred in this particular model unless the fact was distorted in some manner, at which time orienting again appeared. To rearrange the model, as in the case of falsification, seems reasonable. In 1961, Leese affirmed the capability of the Soviets to adapt the Sokolov-Luriya techniques to lie detection if they chose to do so. 2/

By 1961, the Soviets had worked out most all of the visceral and somatic correlates of the learning process including the learning and the manipulation of language. It would be most stimulating to develop techniques to read these behavioral correlates in reverse and arrive at the original verbiage which created them.

New claims have been made by the Soviets for their advances in electroencephalographic techniques. It has been stated that analyses of high frequency brain waves permit differentiation between different types of mental activity, i.e., a shift from such an activity as language translation to working arithmetic problems. 3/ These

analyses are being done with 100 to 400 lead, high frequency machines not possessed by the West. The use of the electroencephalograph machine for rating emotional changes has long been known in both East and West, but the addition of the intellectual diagnostic accomplishment is strictly a Soviet claim.

In 1958, N. I. Zhinkin pointed out that Pavlov's concept of signaling in the higher nervous system provided sufficient grounds for the investigation of the general theory for the function of signals. 4/ This is the course of development followed also by the theory of information which has raised the question about basic units for transmitting and measuring communications, and is making use of the mathematical theory of probability with a view to solving it. The investigation of the structure and types of signals, (including words and speech stimuli) has made it possible to find a common value which is being studied in engineering theory of communications, linguistics, psychology and physiology. The most remarkable fact, states Zhinkin, is the possibility of producing a conditioned reflex response to word meanings. In his opinion the process of thinking contains some elements that can be successfully performed by a cybernetic machine.

Such a statement as this was, no doubt, of interest to A. N. Sokolov also of Moscow State University. For many years he has been working with muscle action currents (myograms) obtained directly from the muscles of speech. 5/ He has found similarity between the myograms obtained during overt speech, on the one hand, and thinking, on the other. On this basis, he has proposed that the thinking process is a "feedback" mechanism involving the vocal musculature in a fashion quite like that observed in audible speech. It was A. N. Sokolov's notation which prompted the Surveyor item of 12 August 65 "Can Cybernetic Machines Accomplish Mind Reading?"

The technique for testing the proposition is not too difficult, but tedious. It would entail the recording of electromyograms from vocal musculature during the recitation of fixed verbiage. Phonograms of the voice should assist in matching the muscle potential characteristics in order to establish probability values. The data gathered would be used to establish an algorithm or formula for programming the computer. When the data

samples are large enough and varied as to verbiage input, the myograms recorded during the thinking process may be scanned by the machine. If the operation is successful on a limited experimental basis, it could be enlarged to cover the average verbiage of the populace in general. Such a "mind reader" seems not too far in the future, and should simplify the art of lie detecting, since it is direct. The polygraph would still be useful as an emotional detector.

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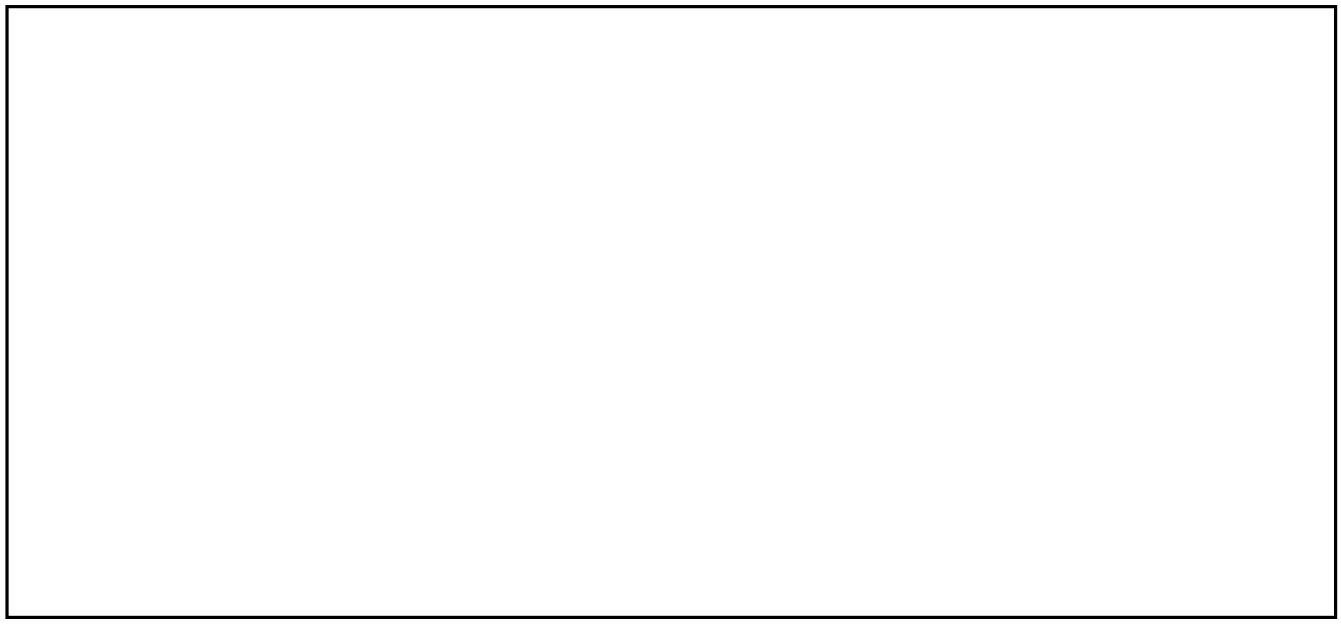

REFERENCE MATERIAL:

1. Luriya, A. R., The Nature of Human Conflicts, (Translation) p 80, 1960.

2. Leese, C. E., Scientific Intelligence Digest 61-17, 21 Aug 61.

3. AMD-TR-64-17

4. Zhinkin, N. I., "Some Problems in the Application of the Information Theory to Psychology," Problems of Psychology, no 1, 1958.

5. Sokolov, A. N., "The Characters of Unspoken Thought," CIA Summary #5281, 9 Jan 64.

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APPENDIX 2

BACKGROUND MATERIAL ON SOVIET VIEWPOINTS LEADING TO THE 'MIND READING' RESEARCH

Part A -- Signal Systems

An introduction to the position of speech in the Russian approach to a behavioral hierarchy would begin with the consideration of phylogenetic learning. This represents the species accumulation of instinctive responses to natural stimuli, chiefly survival, which have developed over eons of time and constitute the organism's inborn behavioral repertory. The whole inborn behavioral complex constitutes the organism's battery of unconditional reflexes, or its only fixed reactive patterns.

Next in order are the organism's experiences over its lifetime. During ontological development, myriads of stimuli from both the external and internal environments impinge upon the organism. Through association with natural (unconditional) stimuli, the unnatural (conditional) stimuli gradually become adequate to produce responses for which they had no original potential. This type of stimulus-response organization results in an accumulation of conditional responses by way of Pavlov's theory of temporary connections within the nervous system. These temporary connections create learned behavior. The learning is temporary in that it must be reinforced by unconditional stimuli, or it will be forgotten (a process of extinction). This then constitutes the organism's learned experience as compared with its unlearned, inborn, behavioral capabilities.

What has been said applies to the organism as an individual (self). It represents chiefly a level of physiological development. The child, in common with other animals, has inborn reflexes and primary conditional responses derived from sensations, perceptions, memory, rudimentary thought, and direct impressions of the environment. His response to the environment, like that of animals, is expressed as an array of limb, trunk and head movements including varieties of facial expressions and vocal utterances such as crying, laughing and other vocal expressions below the level of speech. All of this ontogenetic learning constitutes

the so called first signaling system. It is a stimulus-response system involving behavioral changes preceding the level of cognition. In a sense, it represents the total expressive ability of most animals throughout their existence, and man up to the average age of 1.2-1.6 years.

The next behavioral advancement is sociological. It is transitional between sub-speech and speech behavior and provides the stimuli needed for the gradual conditioning of phonetics for objects in the process of word formation. Conditioning advances sentence structure and finally the entire speech capability. Social contact, particularly parental, is necessary to shape the course of speech maturation, it cannot be done by the self. In Pavlovian terms, speech represents the second signaling system.

Man possesses two great drives, namely, the self, which is organized by the first signaling system at the sub-speech level, and social, which is organized by the second signaling system at the level of speech organization. The first drive is chiefly physiological, the second is sociological. Together they provide the background for the growth of cognition which marks man's emergence into the psychological sphere in which the second signaling system dominates the first. With his mastery of speech man can delve into memory, ideation, conceptualization and judgment formation. All of his cognitive capabilities are made possible through overt and inner (thought) speech.

REFERENCE MATERIAL:

1. Vygotsky, L. S., Thought and Language, Moscow, 1934.

2. Georgiyev, F. I., "The Problems of Sensory and Rational Cognition," Problems of Physiology, no 1, p 28-41, 1955.

3. Aslanov, A. S., "Problems Connected with Joint Activity of the First and Second Signal Systems," Journal of Higher Nervous Activity, no 8, p 192-202, 1958.

4. Luriya, A. R., "Verbal Regulation of Behavior," The Central Nervous System and Behavior, Conf. #3, Macy Foundation, p 359-423, 1960.

Part B -- Bodily Response to Speech

Man possesses two behavioral systems, one is somatic which responds to the external environment and the other is visceral which responds to the internal environment. These are quite inseparable and both usually respond simultaneously to any stimulus. Most stimuli of the external environment call for man's adjustment to, or the manipulation of things external and this is accomplished by skilled learning or intellect (objective manipulation and speech). Man is seldom neutral to these responses unless habituated and expresses a feeling (affect or emotion) toward them by way of the visceral system. Emotional factors become strong modifiers of both overt and inner (thought) speech. Thus bodily action, speech, and thought trigger both somatic and visceral behavior.

Ye. N. Sokolov and A. R. Luriya, both of Moscow State University, as well as other Soviet investigators, have referred to such behavioral arousals as the orienting reflex. This reflex, which is a pre-conditional reflex, has been examined in both its somatic and visceral components. Somatic components are changes in the tone of body muscles, eye movements, and movements of the head. Visceral components are changes in blood pressure, heart rate, respiration, vasomotion, and the psychogalvanic reflex. Beyond the state of arousal, the personal and social implications of a stimulating word, phrase, or thought prolong the behavioral responses. The question arises as to whether these behavioral responses to inner speech, or the thought processes, can be interpreted by way of their objective analysis.

REFERENCE MATERIAL:

1. Sokolov, Ye. N., "Neuronal Models and the Orienting Reflex," The Central Nervous System and Behavior, Conf. #3, Macy Foundation, p 187-276, 1960.

2. Luriya, A. R., The Role of Speech in the Regulation of Normal and Abnormal Behavior (A series of lectures presented by Luriya to the author in 1960).

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